Massachusetts Forestry Association
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Silviculture of White Pine (Pinus Strobus)

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Massachusetts is one of the half-dozen greatest lumber-producing states of the Union, acre for acre. We cut more white pine annually than all other species put together; something over two hundred million feet: and yet we can supply less than half of what we consume. Our soil and climate are well suited for the growth of this valuable wood. We have grown and can again grow trees of fine quality; but by our present methods, or lack of all method, we only obtain very little besides the poorest grades. So we are obliged to import great quantities of the better quality at exceedingly high prices.

It is realized by many that we must sooner or later grow much more and better pine throughout the state, but there is great uncertainty as to the proper methods of procedure. The Massachusetts Foresty Association, in publishing this bulletin, wishes to stimulate the movement; but the writer assumes all responsibility for the statements, theories, and suggestions herein contained, and, in fact, solicits any criticism which will throw more light on the subject. Some of the following statements are universally accepted while others which are from recent observation and experiment should be further tested.

We have no satisfactory precedent to show us what to do with our woodland as we now find it. We could grow as fine, great, clear trees as are seen in the few remaining samples of "old growth" by making a dense start of about fifty years and a gradual thinning for an additional century or two. Our better second growth, with a comparatively small acreage in the state, is either producing knotty lumber from having been too open through its early stages or is growing so slowly from later crowding that the rotation is unprofitably long. Still worse, there are thousands of acres of woodland which have enough young pines to give a very valuable crop if properly managed but where either the growth is too open or the good young trees are suppressed. In American plantations the usual six by six foot spacing gives too much room for the first twenty years and too little later. The German close planting furnishes beautiful young stands, but too late thinning makes an unnecessarily long rotation, and even then there are many knots, though small.

Our problem differs widely from that of Europe: Stumpage values

here are lower; labor is higher; we have little or no market for slash or the material from improvement thinnings; the rate of interest is higher, necessitating quicker returns; and the great variation of values for the different grades calls for a high quality of product.

To determine the system of silviculture best suited to our needs, we should consider some of the characteristics of the tree.

The white pine grows well and rapidly throughout the state but cannot stand too severe exposure. It suffers when isolated after protection, by the drying effect of the wind where the natural leaf wall round a tract is destroyed, and by lack of ground cover. The value of the lumber depends chiefly on the absence or presence of knots and their size and character, varying from $15 or $20 per M. for low grade box boards to $120 for old growth clear stock.

The tree naturally grows with a single leader whether in the open or shut in by other trees. But this development is often interfered with by the Pine Tree Weevil, Pissodes Strobi (see U. S. Department of Agriculture, Circular No. 90). The weevil is a little grub which bores under the bark and into the wood of the terminal shoots of this species of tree, causing the "die back." In a thick growth, by competition, one of the highest laterals forms a new leader with only a temporary check and a very slight crook, hardly noticeable in later years; but in the open two or more laterals compete for the leadership, all live, and a forked tree results, forming a "pasture pine." The remedy is to prune back all but one of the highest laterals; and to break or cut off the affected parts and burn them in July after the tops have wilted and before the beetle has flown. The height growth, which for the early years is most important, reaches its maximum between the tenth and twentieth years, and then for a long time maintains a good but slightly diminishing increment. It is greatest where the tree has ample room but is not isolated. Excessive crowding does not "force up" the tree, but slightly retards it and reduces its vitality. Artificial pruning and the suppression of branches do not materially effect height growth either way. The tree is more tolerant of shade in its early years than later, though stunted in its development when under cover. In the forest the lower branches are soon killed by shade but are very persistent, often even the smallest remaining on for thirty or forty years. The number and vigor of the needles determine the amount of wood formed. Of two plots with equal density of shade, the one with the fewer trees makes more rapid diameter growth with no loss in the amount of wood formed, thus shortening the rotation for a required diameter.

When a branch dies its base is surrounded by the new wood of the bole, and it becomes imbedded in the body of the tree, forming a loose black knot. In case that the branch is cut or broken off not too roughly outside of the bole, the new wood closes in snugly round the stub; but if, as often happens, it is broken off some years after death within the trunk of the tree, the hole thus formed catches sap and dirt, forming the much despised "pitch pocket." On the other hand, a small living branch cut off by pruning knife or saw close to the bole is rapidly covered without either a loose knot or pitch pocket, and the wood is clear and straight grained very near the wound. It is a disadvantage to cut the branch first a foot or two from the bole and then two or three years later to take off the stub. Hot summer weather is best for pruning but not essential.

Trees can be topped or competing leaders pruned to determine the form of the tree without bad effects.

As a result of the experiments of Nathaniel Morton in Plymouth, Mass., and later investigations by the Eric Forest School, confirmed by comparison with independent work of O. M. Pratt in Holderness, N. H., and others, the Eric system of silviculture has been formulated. Our aim is to secure a fair quantity of large, clear, high grade timber with a short rotation. To accomplish this we pay special attention to a small number of selected trees from the start; obtaining a tall slender tree with a clean bole of the desired height and then a rapid diameter growth. Consider first an individual selected tree, whether planted or from natural seeding. In its earliest stages both dense shade and great exposure are avoided; later the top is kept free from obstruction and a single leader maintained. Pruning close to the bole is begun before the lower branches die or become over half an inch in diameter and is continued by taking off two or three whorls every three or four years. The top is maintained from one-half to one-third of the height of the tree. At the end of this first stage of growth a typical tree is about 20 years old, 26 feet high, four inches diameter breast high, three inches diameter at the top of a 17-foot clear trunk (allowing for a 16-foot log), and has a head completely alive eight feet in diameter. In the second stage all of the branches are kept alive and vigorous by giving them sufficient space to grow. In this way an average diameter growth at the top of the first log of from four to five-tenths of an inch a year is maintained till the time of cutting arrives. Then you have one fine sixteen-foot log of high-priced clear wood with a four-inch core containing very small red knots. Considering the tract as a whole: The treatment must vary according to whether you are working for a selection forest or for clean cutting. In either case not more than 100 or 150 trees to the acre should be allowed to mature. These are selected early and all others made subservient to them; the latter being taken out, lopped or topped as may be necessary to give room. But as complete a ground cover as possible is maintained. The best treatment of these secondary trees will depend on the market which develops for such material as they produce. This system is well adapted for a three-story selection forest, and many of our old pastures, with their uneven aged natural stands, lend themselves readily to this treatment. A triangular spacing is best with the selected trees 20 feet apart, bringing those of the same age 35 feet from each other and securing 120 trees to the acre, 40 of each age. After a cutting of the oldest class several seedlings are planted in each gap, from which the best is selected later. In a planted or even aged natural stand it is important to avoid pruning trees which are to come out early. When clean cutting is to follow, the trees chosen for the last thinning must either have small tops or be lower than those left. If, however, a three-story selection forest is to be established, the boles of the three classes are pruned to different heights and the trees of the first two classes to come out are topped.

The financial side—first omitting all pruning: Most authorities agree that under fairly favorable conditions planting pays five per cent. or more on the investment. Numerous reports substantiate these figures, even with annual taxes and the rapidly rolling up compound interest. Where natural reproduction is good, as is so often the case in our cut-over land and

abandoned pastures, an equally fine stand can be obtained by opening up round the selected trees at much less expense than by planting and in a shorter time on account of the start already made. But silviculture, like all other industries, must be conducted intelligently, and many experiments have failed either from unwise management or unfavorable conditions not appreciated till too late; and the danger of loss by fire and pests cannot be neglected. To find whether prunning pays, compare the increased cost involved in this treatment with the improvement in the quality of the lumber. With labor and supervision at 30 cents an hour; interest, 5 per cent.; taxes, 1 per cent.; clear bole for 16-foot log; and 33 per cent. added for good measure; the cost of pruning stands when the work is completed at 10 cents a tree. Compound interest brings this up to 57 cents thirty years later with the tree fifty years old. If you start with a diameter of two inches at the small end of the log, a five-tenths-inch increment gives 17 inches diameter, and 225 feet B. M. in the butt log. Considering that the value of the top remains unchanged, the increased cost per M. of the butts is only $2.50 and with four-tenths-inch increment it is $3.60. Figuring by the acre and taking the sample plots of Cook's, Mass., tables of Mensuration of White Pine, Quality II. (natural reproduction and uncared for): The trees were more than twice as numerous as they should be; but even with the 240 to the acre the cost of pruning would have been between $4 and $5 per M. for the butts. The value of fully half of the lumber in these logs is changed from under $20 to more than double that price, while the other portion increases materially, though not to such an extent. This means that judicious pruning brings good returns on any good or fair stand which is being reasonably cared for; and some years' experience in this work has confirmed the writer in the opinion that wherever white pines are being raised for timber no mistake is made in pruning selected trees of not over four inches diameter.

The individual land owner who has any young pine growing should see that it is given a fair chance by roughly cutting away less valuable material and getting rid of extra leaders. This is as important as hoeing his corn. If he has more time or in succeeding years he can to good advantage carry the work further of opening up as needed, pruning and getting rid of weevils. Corporations and owners of large tracts can still less afford to leave this work undone. All good tracts for sale should find a ready market and form a good investment to be developed by purchasers with time or money. It is both more important and more profitable to develop what is already started than to plant, but the better open lands can wisely be planted as investments. All forest and waste lands not privately developed should be included in municipal and state forests and administered for the common weal, even those which do not at present promise financial returns. Fire protection must be developed even more thoroughly; more ready sale by the producer, particularly the small owner, provided for; the utilization of the poorer wood and bi-products developed; and scientific investigations continued. The Massachusetts Forestry Association, its branches and individual members can take as one line of work the extension of silviculture of white pine; and it is especially important to get together with the foresters and woodland owners in a concerted action to investigate different systems critically and as rapidly as possible bring our woodlands into a more productive condition.